

Excavations at Bagumbayan, Masbate, Central Philippines: An Economic Analysis

Received 2 June 1982

JAN BAY-PETERSEN

THE EXCAVATIONS AT Bagumbayan, Masbate, Central Philippines, were part of an archaeological field program that covered three field seasons, and lasted nearly a year. The site lies on the northeast coast of Masbate, on the outskirts of the town of Palanas (Fig. 1). It is situated 300 meters from the sea and 600 meters east of the Palanas River, which carries a substantial head of water throughout the year. North of the site the coastal plain stretches to the sea; immediately to the south the ground begins to rise into the low but rugged hills of the interior (Fig. 2).

The soils of the interior are predominantly clays or clay loams over limestone bedrock, while those of the coastal plain are mainly a derived and very similar clay loam, merging into sandy soils and finally marine sands at the coast.

A site survey carried out by the author in 1978 had located a number of open-air sites along the coast near Palanas. Bagumbayan itself was discovered when a local well dug in 1980 cut through archaeological deposits in a heavy grey gley clay at a depth of nearly 2 meters. There was no archaeological material on the ground surface, and, if Bagumbayan is typical of early sites, it is hardly surprising that most of the open-air sites found during the survey were fairly recent. Out of the total of 86 open-air and a number of cave sites found during the survey, 67 percent are Iron Age, most of them with imported pottery dating from the tenth to the sixteenth centuries A.D. (Bay-Petersen 1981).

Excavations by Wilhelm G. Solheim II at the famous Kalanay Cave, on the west coast of Masbate, and at Batungan Cave 25 kilometers southeast of Kalanay, had provided evidence that settlement in Masbate was well over two thousand years old. Material from Batungan has been dated to 760 B.C., while the Kalanay tradition appears to date from about 400 B.C. (Solheim 1964, 1968; Bellwood 1978).

Remains of *Elephas*, possibly associated with flake tools, have been found on the nearby island of Panay, which formed a continuous land mass with Masbate and Negros during the Pleistocene glacials (Coutts and Wesson 1978:22). Two sites discovered during the site survey of Masbate contained large core tools with alternate flaking along the working

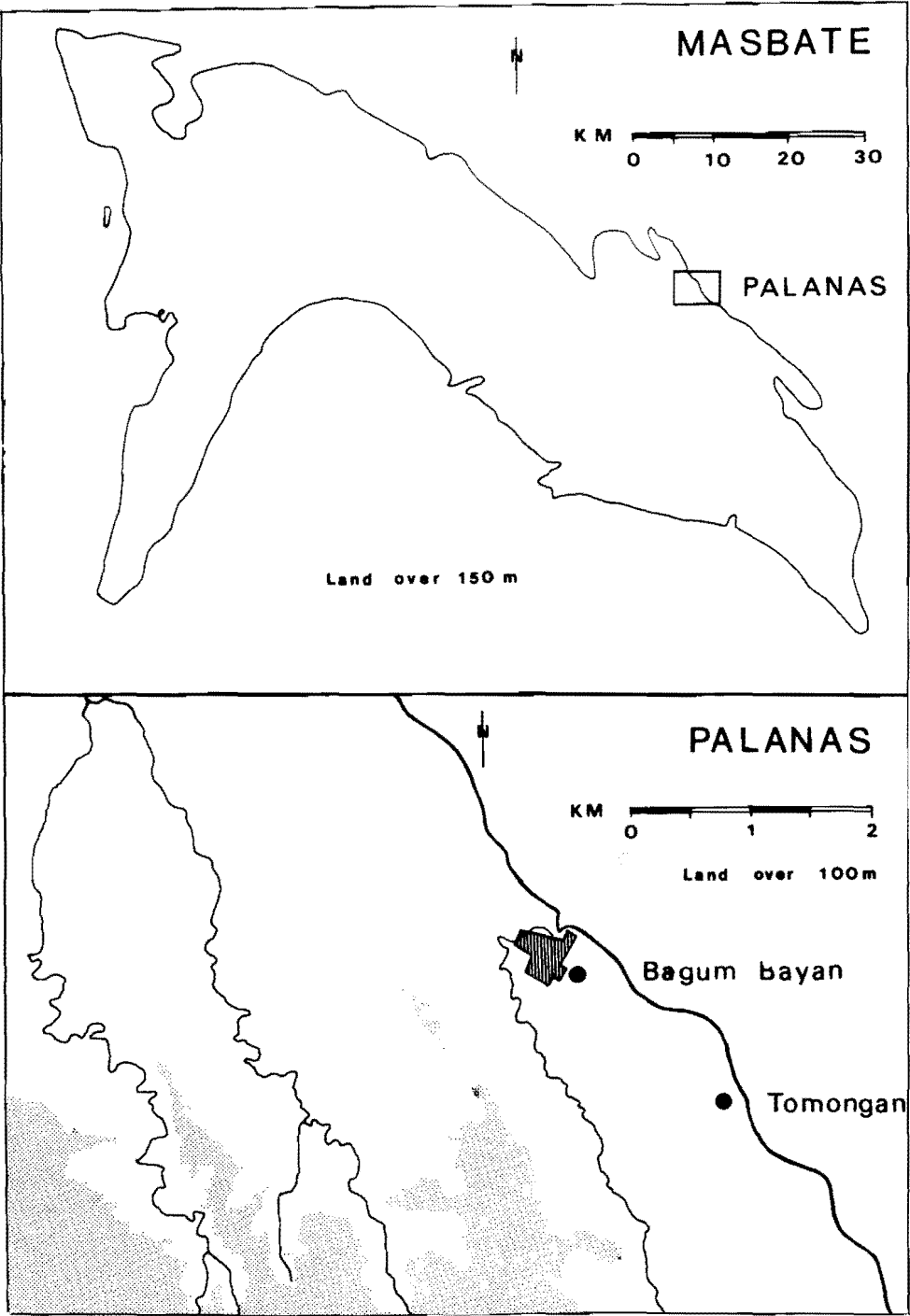


Fig. 1 Masbate.

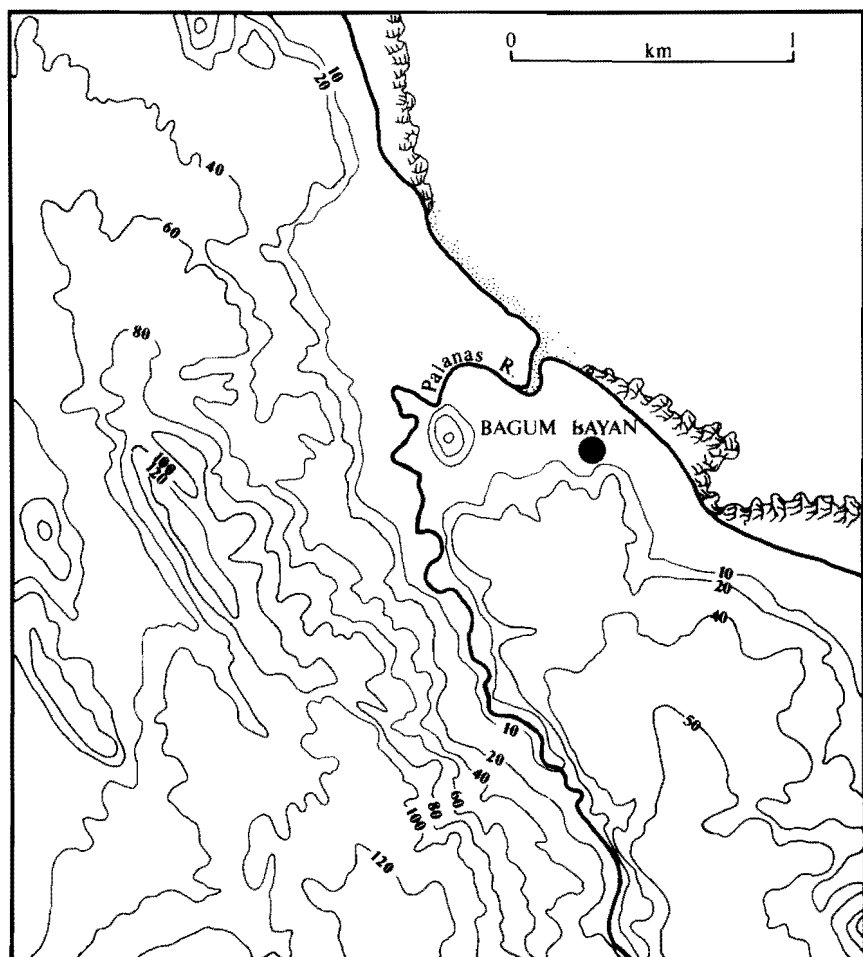


Fig. 2 Map showing topography around site.

edge, very similar to tools found in the Cagayan Valley in Northern Luzon. One site covered several hundred square meters, with a large number of stone tools scattered over the slope of a hillside, but there was no associated stratified deposit.

THE EXCAVATION

Excavation was based on a one meter grid covering the whole site. A total of 187 square meters was excavated, though only 10 square meters down to the deepest cultural deposits, which lay more than 3 meters below the ground surface. The natural soil layers formed the primary excavation units, which were subdivided into 10 cm spits. Three test pits were laid out away from the excavation area (Fig. 3), each 2 meters square, and on the basis of these and the cross section in local wells, it is estimated that approximately one half to one third of the open settlement represented by Layers 4 and 5 was excavated; the cultural remains in Layer 3 may be secondary deposits and are of unknown extent, while

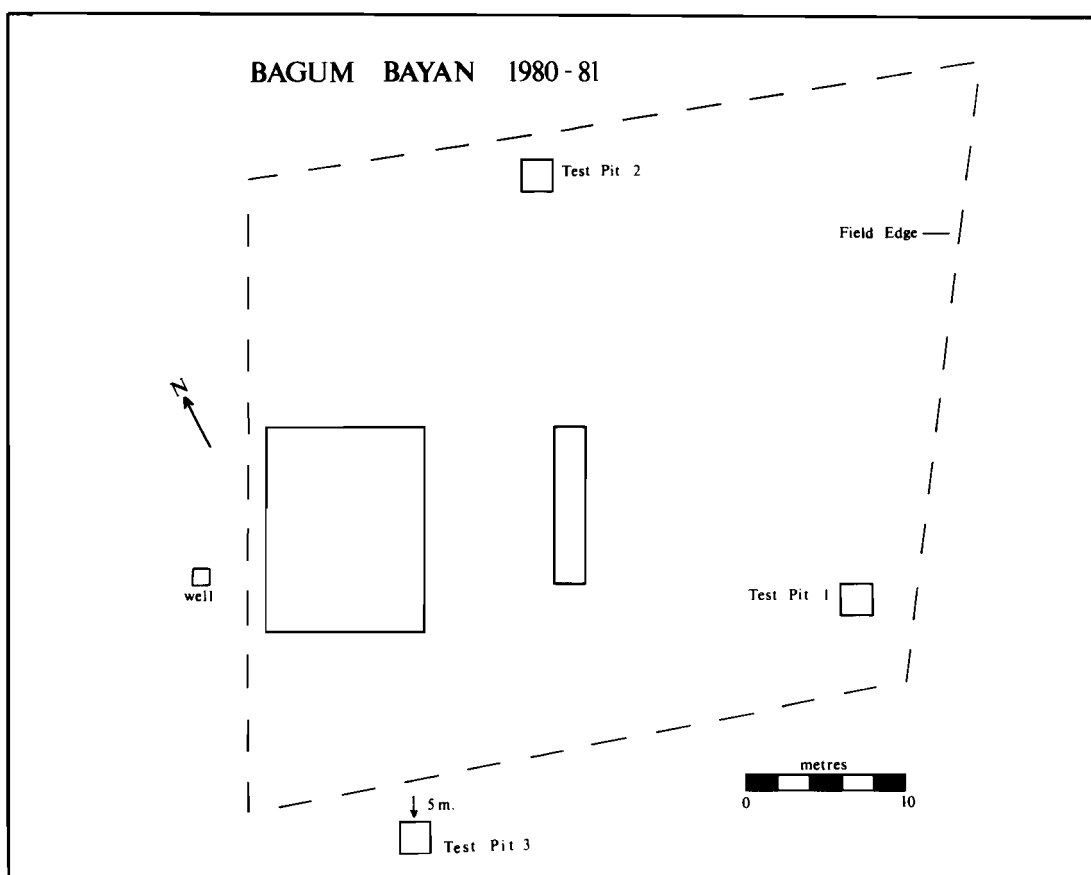


Fig. 3 Map of excavation area.

probably only a small proportion of the cultural material present in the lowest part of the site was uncovered during excavation.

The heavy grey clay excavated from the well immediately west of Bagumbayan, in which cultural materials were present, was not found farther east in the excavation area. The grey clay is a swamp deposit, and at the time of occupation which formed Layers 4 and 5 the site was adjacent to, and slightly higher than, an area of swampland at the mouth of the Palanas River. Today the coastal topography is flat, and both the swamp clays and the cultural deposits are covered by a thick layer of black clay loam, although swamplands are present in the area to the east of the river mouth.

Beneath the clay loam deposit at Bagumbayan is a sandy loam, underlain by progressively sandier deposits, and finally by marine sands and coral. The present coastal plain is slowly extending seaward as it is built up by colluvial and alluvial sediments from the interior, and during the prehistoric period was probably much nearer to Bagumbayan than it is at present. Along with deposition of material there is a simultaneous process of coastal erosion after typhoons or heavy rain.

There were nine natural stratigraphic layers, four of which contained cultural deposits. They are as follows (see also Fig. 4):

BAGUM BAYAN

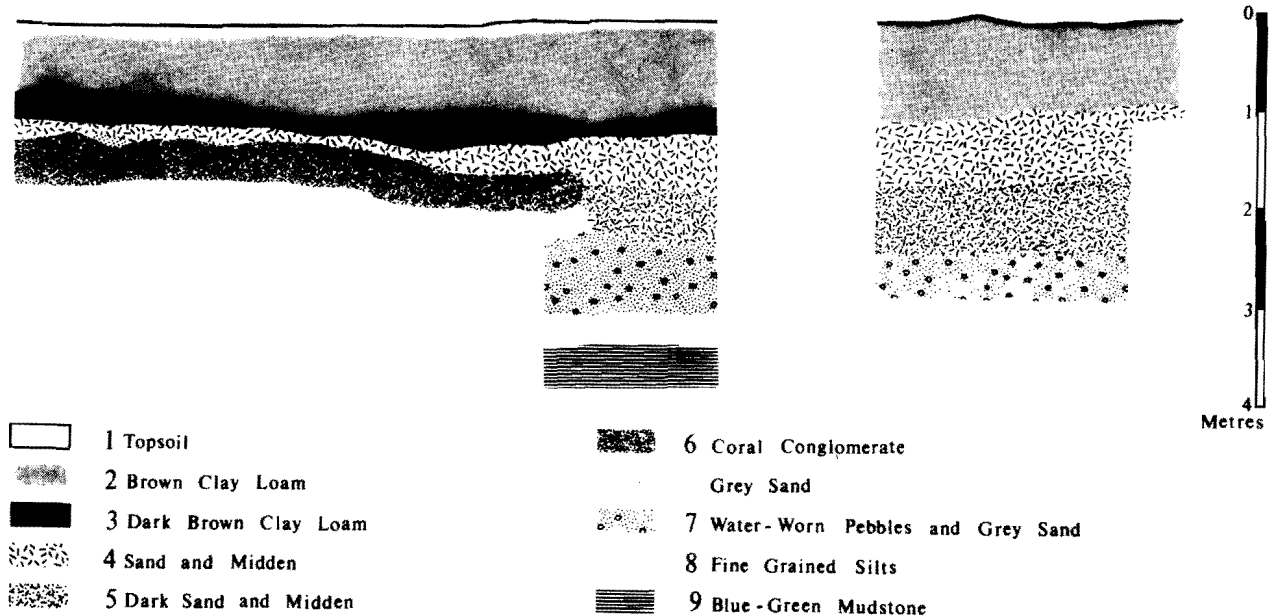


Fig. 4 Plan of stratigraphy of South Baulk.

- | | |
|---------|---|
| Layer 1 | Heavy black clay loam topsoil. |
| Layer 2 | Heavy brown clay loam, with very little sand or gravel admixture. |
| Layer 3 | Dark brown clay loam with little sand or gravel, containing pottery and other artifacts, and some faunal remains. |
| Layer 4 | Sandy brown clay containing shell, charcoal, pottery, and stone tools. |
| Layer 5 | Sandy grey deposit very similar in texture to Layer 4, but with fewer fine particles, containing shell, charcoal, pottery, and stone tools. |
| Layer 6 | Coral conglomerate, made up of large pieces of coral with some sand, shells, and pebbles, cemented into a hard continuous layer with a flat surface, probably worn by wave action. It is approximately half a meter thick, and appears to be internally stratified. |

The conglomerate covers most of the excavation area, and stretches at least several hundred meters to the east, where it is visible in well sections at a depth of 2–3 meters. It is not present nearer the coast, and is not found west toward the river; it appears to stretch in a band parallel to the coast terminating 600 meters from the present Palanas River, with the site excavation situated on its western edge.

Radiocarbon dates from the marine deposits underlying the coral conglomerate and the overlying midden layers (4 and 5) indicate that the conglomerate and underlying marine deposits built up over approximately two thousand years, beginning in the fourth millennium B.C. (see below). The nature of the conglomerate formation is not clear: the shells and sand imply a marine deposit, but formations of this kind are fairly common in the Pacific and are not necessarily formed beneath the sea. They may be beach or other deposits, cemented by groundwater or phosphate deposition.

A very similar deposit has been recorded, for example, at Raine Island off the coast of Queensland, Australia. First described in 1846 as a more or less continuous stretch of coral conglomerate a few feet thick containing rock and shell, it was originally interpreted as a marine deposit, formed beneath the sea and exposed by an isostatic change in sea level (Jukes 1846, quoted in Stoddart, Gibbs, and Hopley 1981). Recent studies of the same formation, however, have indicated that the deposit is a cay sandstone cemented by phosphate deposition (Stoddart, Gibbs, and Hopley 1981).

Whereas the cementation of the Raine Island deposit is superficial, and decreases with depth to a soft sandstone which crumbles readily, that of the Bagumbayan is pronounced and consistent throughout its depth. The Bagumbayan conglomerate is uniformly hard, with well-defined upper and lower surfaces, and cementation, if it occurred above the sea, is probably the result of groundwater rather than phosphate deposition. Since groundwater in Masbate runs through limestone deposits, it has a high calcium carbonate content, and such water passing through beach sands and coral may have formed the cemented conglomerate.

Whether the conglomerate formed beneath the sea or from beach material, since it predates the deposition of the alluvial and colluvial sediments that make up the present coastal plain, its presence implies that the coastal plain seen today is of surprisingly recent origin. Well after the end of the Pleistocene there must have been only a very narrow zone between the sea coast and the hills of the hinterland.

- | | |
|---------|--|
| Layer 7 | Unconsolidated coral rubble and shell with some sand admixture. |
| Layer 8 | Fine-grained silt with some marine shell. Large core tools were found on the surface of this layer, which also contained the skeletal remains of terrestrial mammals and marine fauna. |

- Layer 9 Homogeneous blue-green mudstone without visible inclusions. This layer was seen to extend for several meters in some very deep local wells, none of which reached its base. It is exposed at parts of the coast near Palanas as a flat platform.

THE SITE

Archaeological deposits appear to represent three main occupational phases. The uppermost, in Layer 3, contains pottery with incised crisscross and parallel line decoration identical to that from Iron Age sites with imported porcelains in Palanas and other parts of Masbate.

The associated soil layer, a dark brown clay loam, was heterogeneous, and made up of poorly defined lenses of soil slightly differentiated in texture and color. These differences did not appear to relate to human activity, but to the intermittent deposition of large amounts of soil sediment, perhaps indicating flooding and/or soil erosion from the adjacent uplands.

In present-day Masbate soil erosion is marked, and over 80 percent of the island has lost one-fourth or more of its original topsoil (Soil Survey of Masbate Province, 1964). Much of the precipitation falls between June and February in the form of torrential thunderstorms, the water from which streams off the uplands over the coastal plain carrying with it large quantities of sediment.

It has been suggested in an earlier paper that deforestation as a result of slash-and-burn farming is not a recent process in Masbate, but was well advanced in the Iron Age (Bay-Petersen 1981). This deforestation would probably have produced some degree of erosion and periodic flooding, and would be consistent with the type of deposition that formed Layer 3. Certainly, regardless of any proposed deforestation, soil formation seems to have been the result of irregular and substantial depositional episodes. These are likely to have produced some movement of archaeological material, and some sherds, though not all, were slightly waterworn. They were associated with faunal remains, but no structural remains were identified. Similar archaeological material was found at an equivalent level in all the test pits (see Figs. 3 and 4).

Underlying Layer 3 were the two shell midden layers, 4 and 5, which represent a continuous occupation sequence. They are differentiated by a slight change in the color and texture of the soil matrix, but there are no indications of a break in occupation between the two layers, nor is there any change in the pottery or other artifacts.

Radiocarbon dates support the stratigraphic evidence of continuity. The lowest spit in Layer 4 is dated at 3510 ± 90 B.P. (1560 B.C.), and the adjacent top spit of Layer 5 is dated to 3620 ± 100 B.P. (1670 B.C.) (dates from the Harwell Low Level Measurements Laboratory).

This places the occupation period of the midden layers at a slightly earlier date than Layer 6 at the Pintu Rock Shelter, Northern Luzon, which contained flake and core tools but only a single vessel of the earthenware which became more frequent, though never abundant, later in the sequence (Peterson 1974). The Bagumbayan midden also overlaps chronologically with Layer 5 of the open-air Dimolit site, also in northern Luzon, which contained small flake tools, pottery, and the remains of two small square houses with sides approximately 3 meters long (Peterson 1974). The Dimolit site at this time seems to have been periodically flooded, and the house structures of this level were possibly temporary habitations. The undated remains of large postholes in Layer 3 at Dimolit indicate a more substantial structure, probably with a raised living floor.

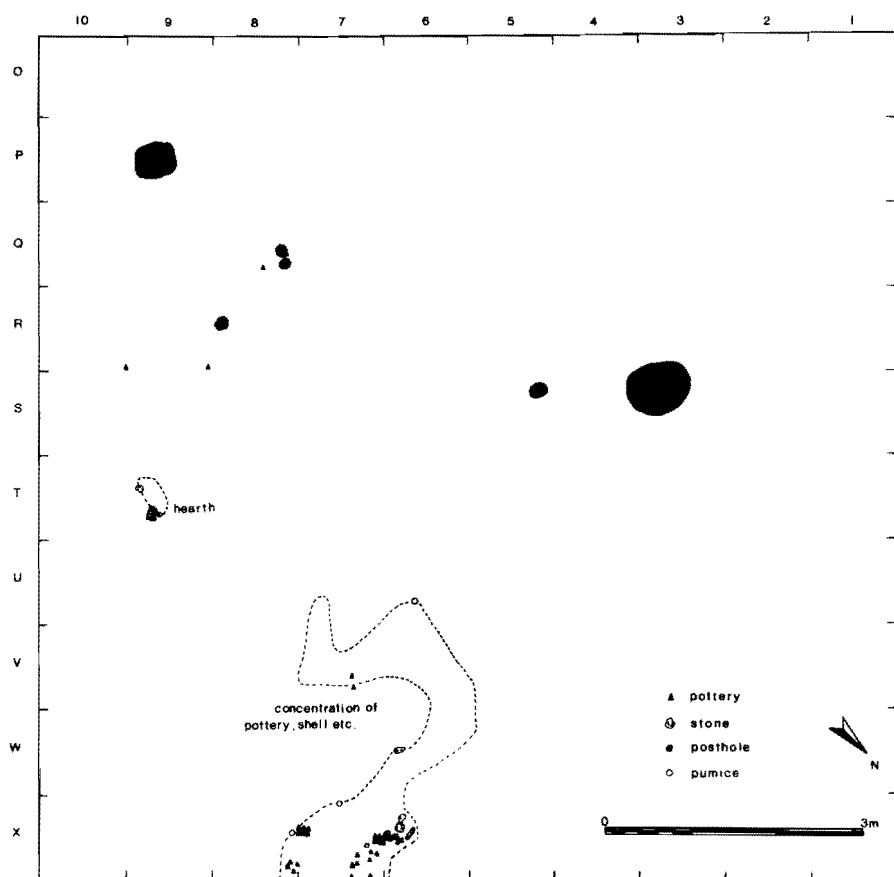


Fig. 5 Site Plan, top of Layer 4.

The two massive, widely spaced postholes at Bagumbayan, extending through the midden layers and associated with small postholes, also indicate a substantial structure, probably permanent or semi permanent and possibly with a raised living platform (see Fig. 5). The smaller postholes may have been a small attached cooking hut: eight separate hearths, mostly on coral conglomerate, were found at different levels in this part of the site.

An extensive rubbish area was found on the eastern edge of the excavation. Although no pit had been dug, domestic refuse, including a large proportion of the total shell and pottery from the midden, was concentrated in this area throughout the midden sequence. Also in this area were found most of the 254 pieces of pumice, between 5 and 25 centimeters long, present in the excavation. Most of these had one or more rounded abraded surfaces, and may have been used for scouring the insides of pots. Pumice is frequently washed up on the beaches of Masbate, and was used locally in the past for this purpose, particularly before earthenware vessels used in cooking were replaced by modern metal utensils.

The spatial separation of (probable) house structures and domestic refuse seen at Bagumbayan is clearly shown in Figure 6, and is probably typical of sedentary or semi-sedentary settlements. It occurs because the daily activity which produces refuse is gener-

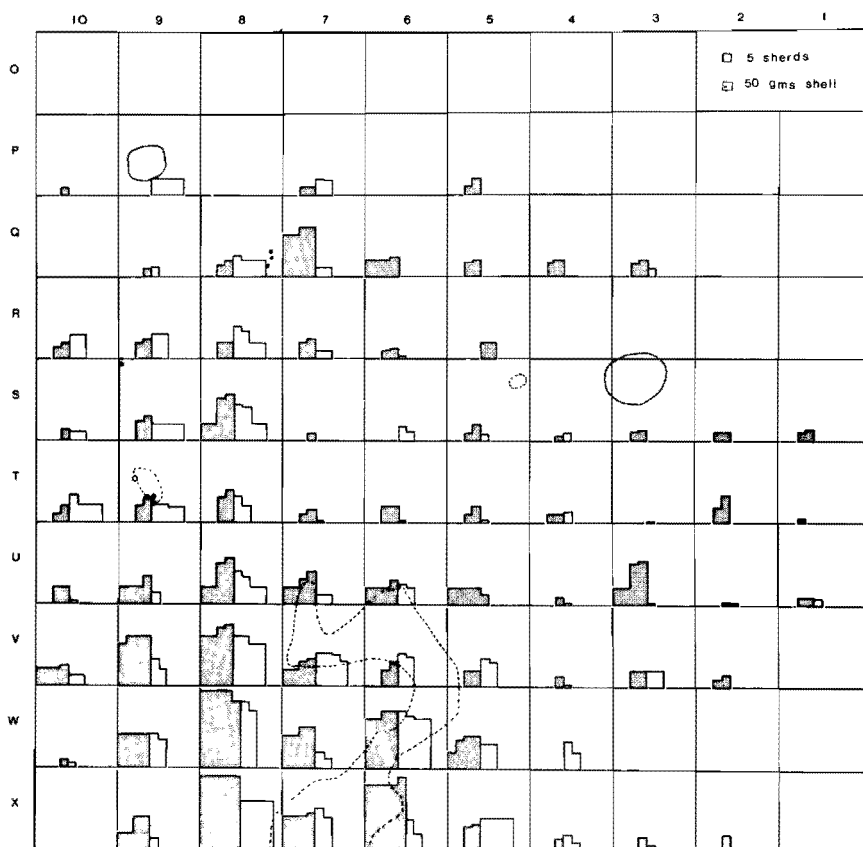


Fig. 6 Plan showing distribution of shell and potsherds, Spit 1, Layer 4.

ally followed by deliberate rubbish clearance. De Boer and Lathrap, who observed this pattern during an ethnoarchaeological study of a Shipibo-Conibo community, remark that

within a sedentary community, primary refuse, where sites of use and discard coincide, is probably ephemeral, and midden accumulates exactly where behaviour is minimal A curious fact about refuse is that while archaeologists obsessively seek to discover it, most people, including the Shipibo-Conibo, seek to get rid of it. (De Boer and Lathrap 1979:129, 134).

This behavior seems to be less evident where settlements are temporary, as in most hunter-gatherer societies, in which case people may distance themselves from their domestic refuse by simply abandoning the settlement. Schiffer has proposed an inverse relationship between the intensity of site occupation (population size, length of occupation) and the level of correspondence in "use and discard locations" (Schiffer 1972; Yellen 1977).

The distribution of potsherds in the Shipibo-Conibo settlement away from houses and concentrated in refuse areas was accompanied by a change in the size of potsherds. Those in areas of high activity, as for example near houses or on paths, were reduced by trampling and were of smaller average size than those in areas where little activity took place (De Boer and Lathrap 1979).

The controlled study by Kirby and Kirby (1976) on the effects of trampling on sherd size show that fragmentation is most pronounced in larger sherds, and that the rate of breakage decreases as sherds decrease in size. After four or five "trampling events," sherds originally 4-8 cm in median diameter have nearly all reduced to a median diameter of 2 cm or less, the rate of reduction decreasing with each event.

All sherds from the midden layers at Bagumbayan were analyzed in terms of size. Since the pottery in these layers was soft and extremely fragile (see below), the estimation of sherd size based on the number of sherds per unit of weight, as described by Bradley and Fulford (1980), was not technically feasible: each sherd had to be handled separately and with great care. For the same reason it was sometimes difficult, when vessels had been discarded largely intact, to distinguish postdepositional breakage which had occurred as a result of human activity of a kind the analysis was designed to define, from that caused by earth movement and soil pressure.

The analysis illustrated in Figure 7 is based on the proportion per square meter of sherds less than 2 cm square, that is, those which fitted within a 2 cm frame.

If sherd size does reflect the level of human activity, then three main foci can be seen. Two are around the proposed house posts: although the total number of sherds is small, a high proportion of them are small in size. The third, and most pronounced, is on the northern edge of the excavation where domestic rubbish seems to have been discarded. This area was also marked by a large number of sherds, although since diminution in the size of potsherds means ipso facto an increase in their number, this concentration is relatively more marked than in the original material.

In the Shipibo-Conibo distribution pattern, sherds in the refuse area were relatively large. This does not reflect a characteristic of middens per se, but the level of post-depositional disturbance, which in the Shipibo-Conibo village was very slight after the rubbish had been swept away from the houses onto refuse heaps. The domestic refuse at Bagumbayan, including broken pottery and marine shell, may have been carried to the midden area and dumped, rather than swept, or the area may have been on an access route, for example to the beach. Either pattern of activity would account for the distribution of sherd size at the site.

When the period of occupation represented by the midden deposits began, the coral conglomerate lay exposed as a flat platform up to a meter high on the eastern edge of the settlement. The formation was used for fireplaces and hearths, indicated by patches of burnt coral rock, ash, charcoal, and burnt shell. Early in the occupation an antler axe was lost or abandoned in a crevice in the conglomerate. It was made of the antler of a spotted sambar deer (*Rusa alfredi*), and was probably used as a digging tool. Intact when deposited, the shaft of the handle was later broken as a result of soil pressure (see Fig. 8).

Gradually the midden built up and over the coral conglomerate until the formation was almost completely covered, at which point occupation during this period ceased.

The lowest cultural level at Bagumbayan lay beneath the coral conglomerate and the underlying coral rubble and shell of Layer 7. The marine shell in Layer 7 and earlier layers is sparse and is a natural rather than a midden deposit.

Beneath Layer 7, which seems to be a beach formation similar to those found on rocky shores today in the Palanas area, is a layer of fine-grained marine sediments (Layer 8) containing molluscs resembling present-day muddy shore species. Within this layer were a number of other faunal remains. They are analyzed in detail in a later section and include deer, pig, and a number of marine species such as shark and marine turtle. On the surface of the layer, and partly embedded in it, were four chert core tools. The middle spit of Layer 8 has been radiocarbon-dated to 5610 ± 110 B.P. (3660 B.C.).

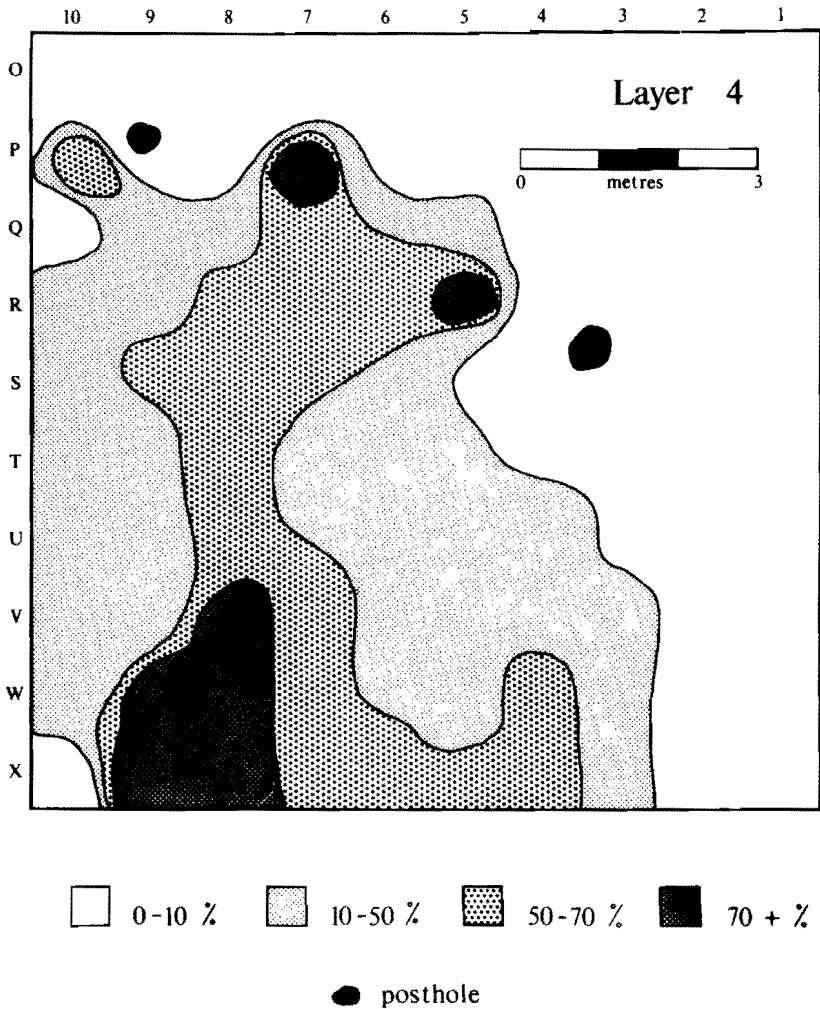


Fig. 7 Distribution of sherds less than 2 cm, maximum diameter, Spit 1, Layer 4.

Since the core tools are present only in the upper part of Layer 8, they may belong stratigraphically to Layer 7 and have been transported to their present position by the same wave action that formed the latter layer. If so, one would have expected a more pronounced degree of rolling than is apparent on the tools. If their position in Layer 8 reflects a valid stratigraphic relationship, they probably originated from close at hand.

The associated sediments are a fine-grained silt, and since the core tools and some of the bones are large and heavy, it seems unlikely that they were washed to their present position: all the geological evidence indicates still or very slow-moving water. The remains may have been thrown into the water, possibly from a nearby settlement where the ground begins to rise 5 meters inland from the site.

The deposit is now more than a meter below groundwater level and is permeated by springs which flow beneath the coral conglomerate. Conditions of preservation are good and the deposit contained several pieces of wood, none of which appeared to have been worked.

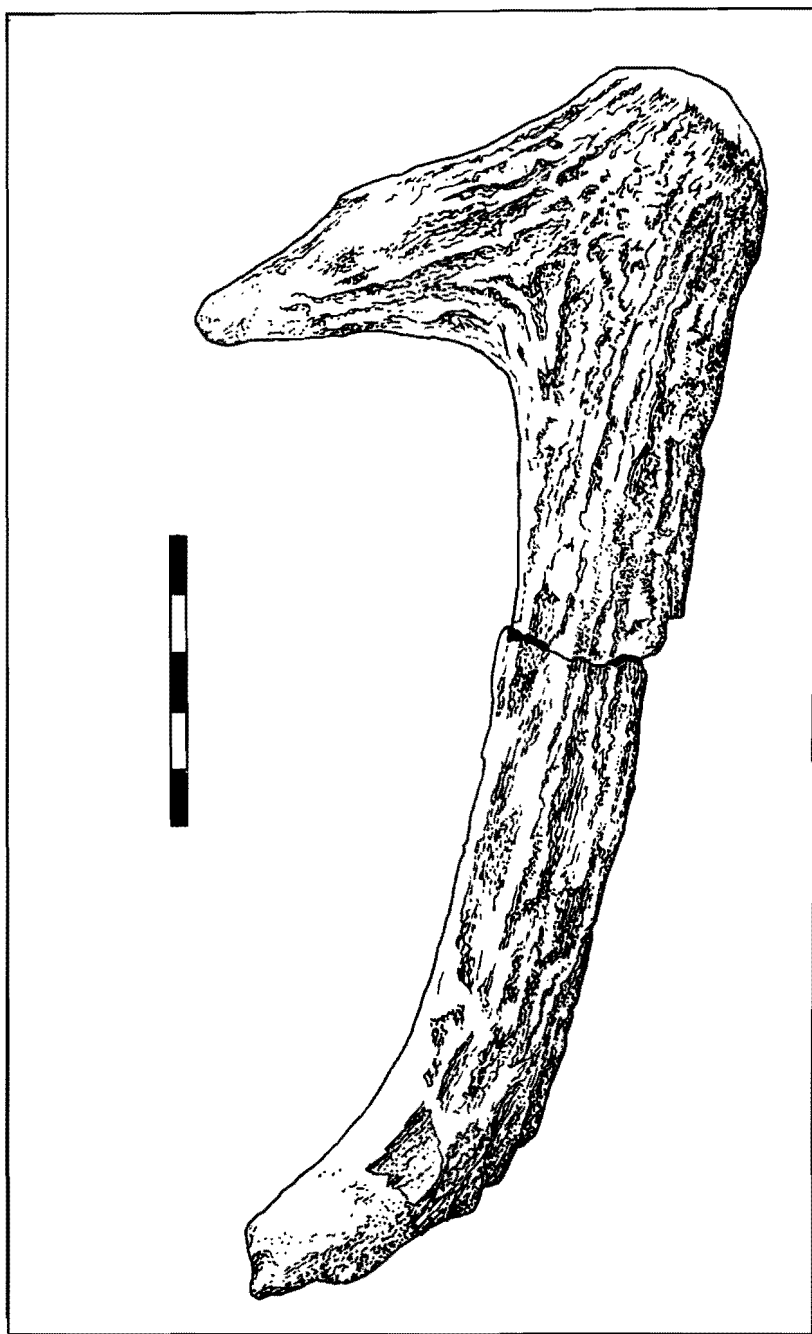


Fig. 8 Antler axe, Bagumbayan.

POTTERY

Pottery was present in the midden deposits and all overlying layers. Most of the sherds in Layers 1 and 2 were unglazed and undecorated earthenware similar to that still used on the island, but they included some red burnished ware and some glazed brown sherds. Also present in Layers 1 and 2 were some small pieces of iron. The material remains in these two layers were few and widely dispersed; they are probably secondary deposits and fairly recent.

Layer 3 and the underlying midden layers (4 and 5) contained 4111 sherds, all of unglazed earthenware. Many of the sherds showed rounded impressions on the inner surface, probably anvil impressions, although the outer surface was smooth and there were no apparent signs of paddling. Possibly the manufacturing process followed that common among traditional Philippine potters today, whereby paddle-and-anvil are used after coiling or hand modelling to shape the pot, which is then smoothed off either by hand or with a wet cloth (Chiong 1974; Scheans 1977). All except one of the pots in these layers were round-based with flared rims; the exception was a rim sherd from a shallow undecorated bowl, found 10 cm below the surface of Layer 4. Except for a single small lug in Layer 3, there was no further elaboration of the basic form.

Thirteen sherds (0.3%) were decorated. A pattern of incised parallel or criss-cross lines in vertical panels around the neck of the pot was found on seven sherds in Layer 3 (Fig. 9 left). The decorative pattern was cut with a knife or sharpened stick and is identical to that found in 19 other Iron Age sites in Masbate, nearly always in association with imported porcelains (Bay-Petersen 1981). The chronological association may also be a causal one, in that the introduction of porcelains may have replaced the local production of wares with the more elaborate incised designs found at Kalanay Cave.

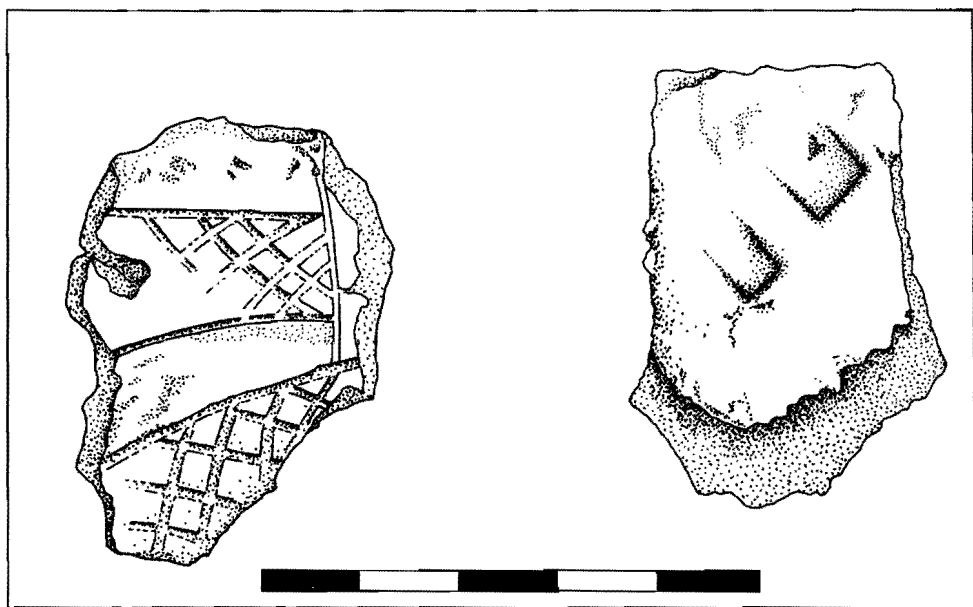


Fig. 9 Decorated pottery. Left: Layer 3; right: Layer 4.

The adjective "local" is used here in contrast to "imported". It is not suggested that the pottery found at Bagumbayan was necessarily made there or even on Masbate itself.

The archaeological evidence suggests that the exchange of goods between the Philippines and other parts of Asia is of long standing. Porcelains are the most conspicuous evidence of that trade, but iron technology and probably iron itself were imported long before the porcelain trade began at the end of the first millennium A.D., as were jade and carnelian ornaments found in preporcelain sites (Hutterer 1977b, Tenazas 1974, Legaspi 1972). As Hutterer (1977b) has pointed out, the maintenance of a substantial trade network must have had a considerable impact on the indigenous Philippine economy in terms of settlement patterns, and production and distribution systems. It seems highly unlikely that the systems of production and distribution used in foreign trade did not also operate within the Philippines themselves; there may have been considerable movement of goods, including pottery, between the different Philippine islands. Unfortunately, since most of the clay soils away from the coast in Masbate are suitable for pottery manufacture, as is probably also true for the geologically similar neighboring islands, a microscopic analysis of the clay composition of pots is unlikely to identify clay sources or centers of pottery manufacture. Pottery with close similarities in form and decoration to that found in Layer 3 of Bagumbayan and other sites in Masbate is also found in Samar and has been reported from Palawan (Hutterer 1969, Fox 1970).

The pottery itself may have been traded or the similarities may be an indirect result of trading contact. Certainly, given the ease of movement by sea, and the fact that most transport of goods was by sea rather than by land, one would be as likely to find similarities in material culture on the adjacent coasts of neighboring islands as in adjacent land areas.

Although the pottery deposits in Layer 3 were fairly sparse, they formed part of a defined occupation layer. They are associated with food debris although no structural remains were found.

It is of interest to compare the earthenware of Layer 3 at Bagumbayan with that of Tomongan, an open-air burial site on the coast two kilometers east of Bagumbayan. Some potsherds of the surface at Tomongan showed the same incised decoration of parallel lines found at Bagumbayan, and the purpose of the excavation was to compare the pottery assemblages from two sites that were probably at least partly contemporaneous but had different functions. This is of particular interest in the Philippines where to a large extent archaeological cultures have been defined on the basis of burial remains alone.

The site of Tomongan covers approximately 1500 square meters (on the basis of surface finds), although only 20 square meters of the site were excavated. Today the site is a coconut plantation and has been extensively disturbed by plowing.

Excavation revealed four jar burials, two of infants, and an extended burial of an adult male. The skeleton of the latter lay on its back facing the southwest (away from the sea), with its hands crossed on its thighs and holding a small iron knife.

Tomongan is a burial site, which Bagumbayan was not, and not surprisingly Tomongan had a higher proportion of decorated wares. Of the total of 4830 sherds excavated at Tomongan, 528 (10.9%) were decorated, while a further 38 sherds (0.8%) were of imported porcelains. The site must have been used as a burial ground for a considerable length of time since the porcelain fragments that could be dated covered the period from Sung to Ming, that is, the whole time span of porcelain imports, although most were from the fifteenth century.

Apart from a sherd from a flat-based pot, all the earthenware found at Tomongan was of the same globular form with flaring rim found in Bagumbayan. Decoration consisted of the same incised lines, either parallel (129 sherds) or crosshatched (329 sherds) in vertical panels around the neck of the pot. The earthenware in both Tomongan and Layer 3 of Bagumbayan was a well-fired reddish ware with sandy inclusions. The rims were smooth and well finished, and many rims and body sherds bore parallel striations, possibly formed when finishing the pot on a turntable or slow wheel.

Five sherds from the base of Layer 3, representing at least two pots, were decorated in pairs of parallel lines formed by a small two-pronged implement (see Fig. 10). Almost identical decoration is seen on several pots from Kalanay Cave, with diagonal lines incised by a two-pronged implement running in a band around the neck (Solheim 1968: 40-42). Decoration seems to have extended further down over the body in the Bagumbayan pots, but the decorative technique is identical. Decoration was carried out with a downward diagonal stroke, with a slight pivoting of the implement at the beginning and end of each stroke to produce a distinctive curve (Solheim 1968). In view of the pronounced similarities, it is possible that the pots were made by the same potter, although the technique appears to have been fairly widespread, in that four of the vessels from Leang Buidane, in the Talaud Islands, were decorated with a two-pronged tool as were some sherds from Sa'gung Rockshelter in Palawan, though in more complex designs (Bellwood 1976, 1980; Kress 1980).

The pottery found in the midden layers of Bagumbayan, although similar in shape to that of Layer 3, was very different in texture and finish. Although there was some variation in color, the earthenware in Layers 4 and 5 was usually of a pale biscuit-colored brown termed Buff Ware. The rims of the Buff Ware were crude and had probably been formed by pinching between finger and thumb with little subsequent finishing. Little or

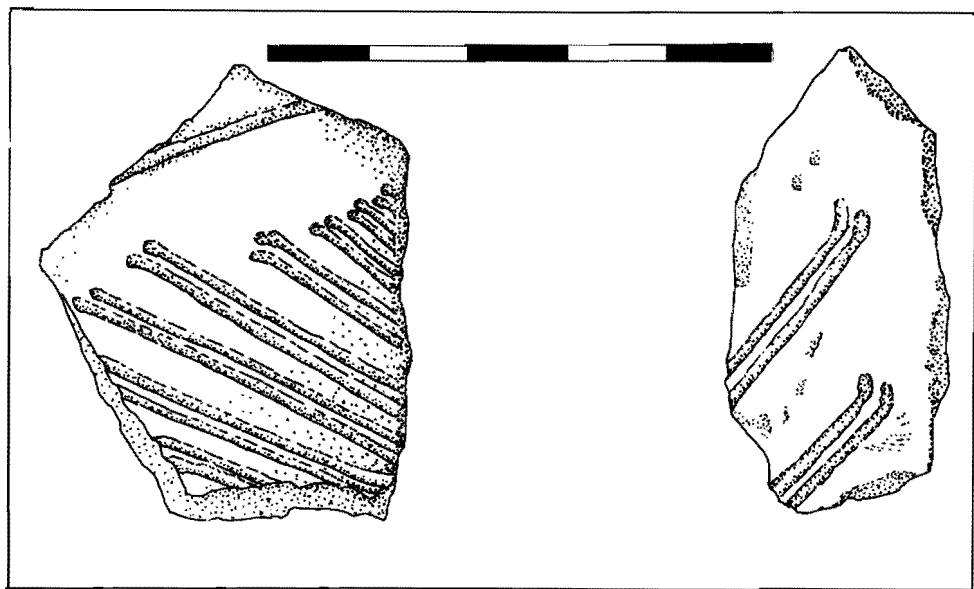
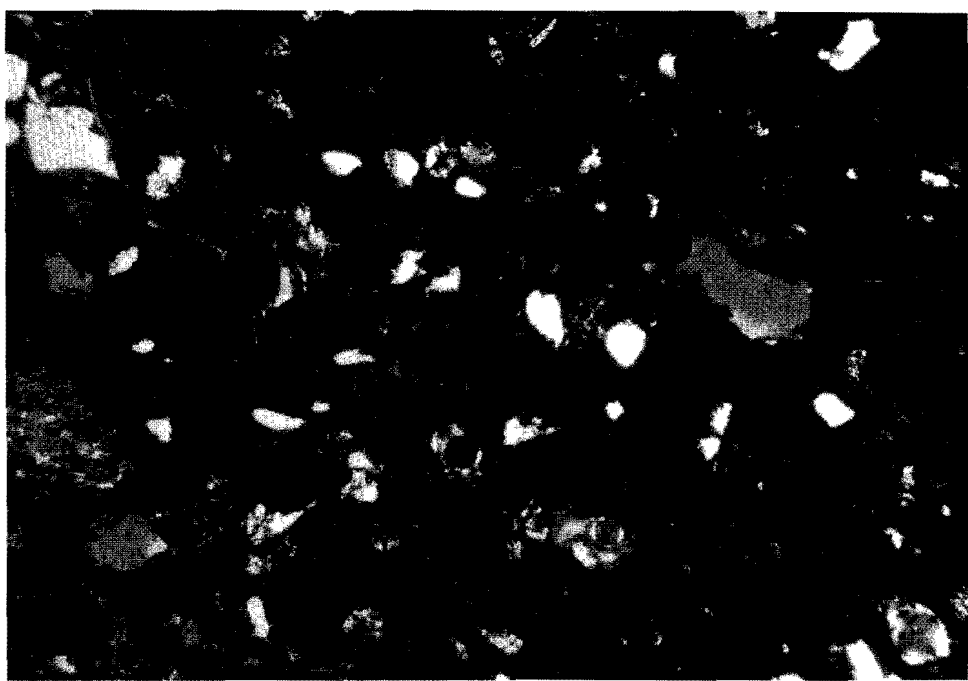
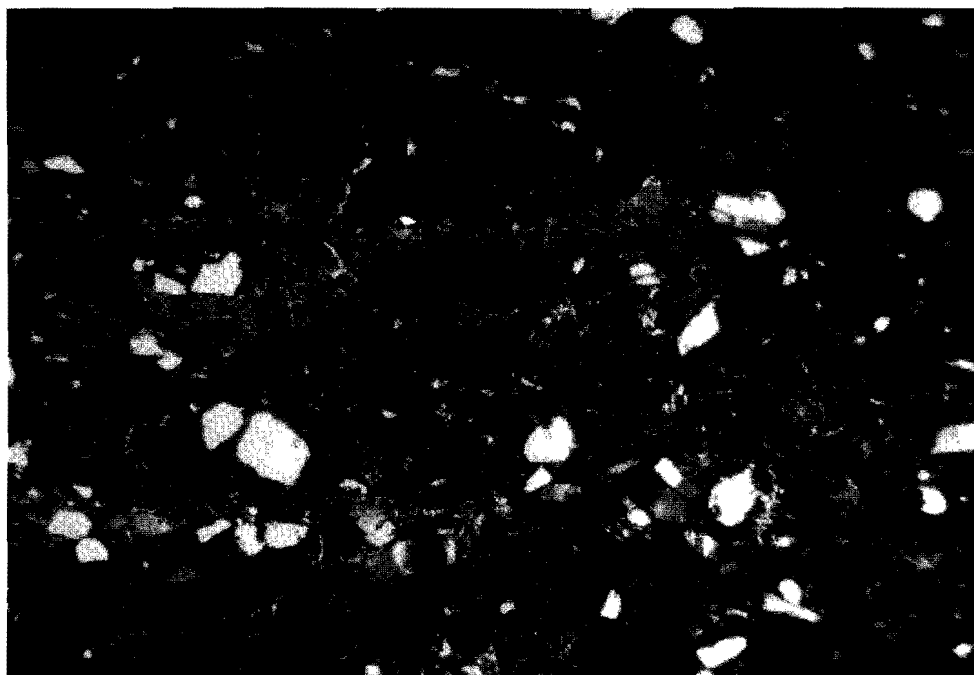


Fig. 10 Decorated pottery, base of Layer 3.



Pl. 1a Photomicrographs of Pottery Thin Sections, magnification $\times 40$, Buff Ware.

no temper had been added to the clay, which was very fine with few or no inclusions. The matrix of the ware was black, the result of being fired at a low temperature or for a short time, and the finished pottery was soft and fragile.

The differences in the texture of Iron Age and Buff Ware are illustrated in Plates Ia and b, which show microphotographs of thin sections (magnification $\times 40$) indicating the large number of inclusions in the Iron Age pottery and their marked absence from the Buff Ware. The lack of inclusions in the Buff Ware is probably, like the low firing temperature and crude forming, a result of limited technological knowledge rather than selective culture-based decisions. Temper is added to clay in the pottery-making process to reduce shrinkage during drying and the possibility of cracking during firing. Quartz sand, one of the most common tempers in traditional pottery making and used for this purpose both in the Iron Age and at the present day, must have been readily available. Indeed, the sandy soils at the site at the time of occupation would probably have served as a suitable temper.

Only one sherd of Buff Ware was decorated. Several other sherds had small marks that did not form a regular pattern and were probably accidentally produced during manufacture. The decorated sherd was stamped with two impressions, each representing two sides of a rectangle (see Fig. 9 right). Stamped impressions, usually of circles, are also found in the more sophisticated and chronologically later pottery of Batungan Cave (Solheim 1968).

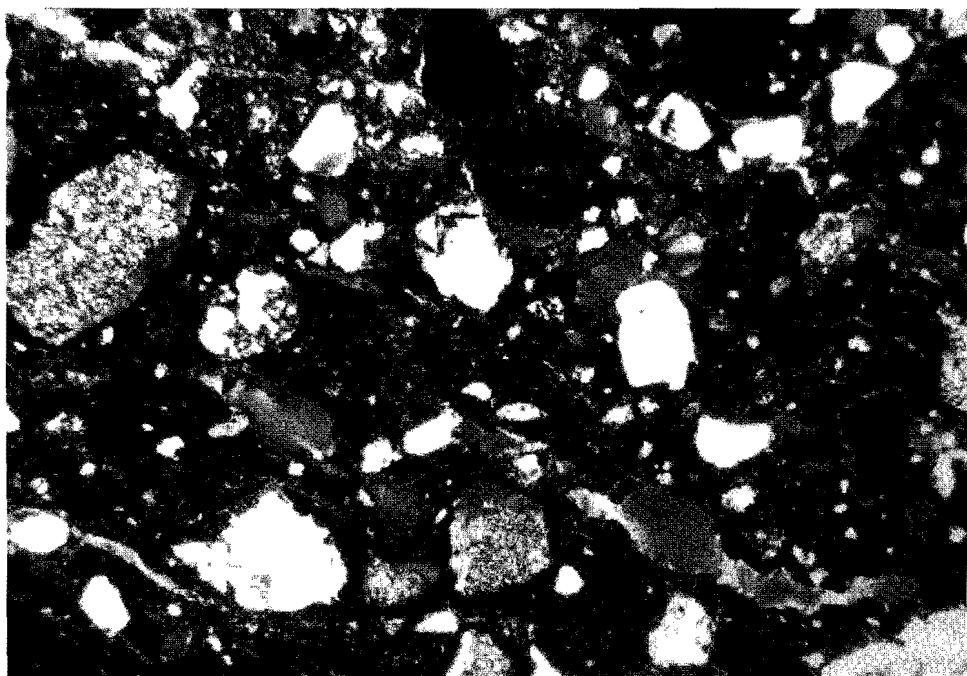
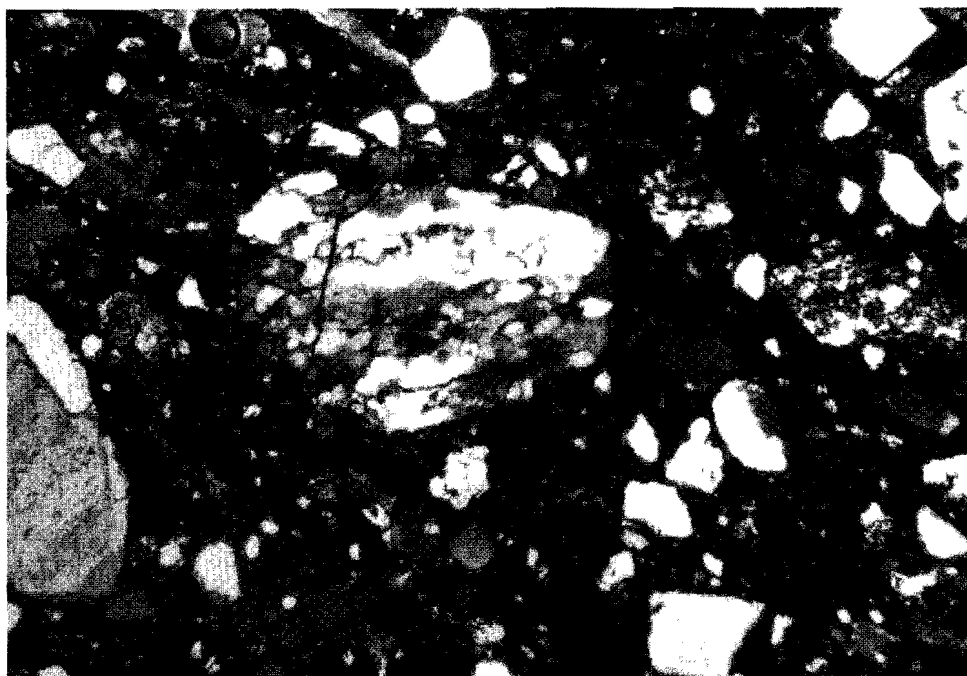
Whether the Buff Ware was produced locally or traded is unknown. Plain pottery is known from the contemporaneous Dimolit site, where the vessels were the same globular forms seen at Bagumbayan, with, in addition, some platelike forms, but approximately 30 percent of the Dimolit pottery was red-slipped (Peterson 1974). Plain pottery was also found in the Sulu Archipelago, in Sohoton I Cave in Samar, and in the Talaud Islands in northeast Indonesia (Bellwood 1976, Hutterer 1974, Spoehr 1973). No other Buff Ware was seen during the site survey of Masbate.

STONE TOOLS

Twenty-seven stone tools, made from a variety of raw materials and representing three different lithic traditions, were found at Bagumbayan. The two most closely related in terms of form and technological level were the most recent, in Layer 3, and the earliest, in Layer 8. A number of stone objects found at the site—particularly rounded limestone pebbles with signs of bruising—may have been used as tools (hammer stones), but since they were not modified for use are difficult to distinguish from natural objects and are not included in this analysis.

The six stone tools in Layer 3 were fairly large (4–10 cm maximum length) and were crudely flaked by direct percussion from chert, limestone or quartz. Chert is not common in Masbate, and the only raw chert I observed were occasional river pebbles or stone eroded out of the parent limestone and found in riverbeds among large quantities of limestone, the most common rock in the area.

The Iron Age stone tools were generally as thick as they were wide, and consequently the conventional distinction between flake and core tools is difficult to apply to these artifacts. There is no retouch, and the lack of striking platforms on some of the larger tools indicates reduction by striking or smashing against anvils, as is recorded at the Paso site on Sangihe Island in Indonesia and Sohoton Cave on Samar (Bellwood 1976; Tuggle and



Pl. 1b Photomicrographs of pottery thin sections, magnification $\times 40$, Iron Age Ware.

Hutterer 1972). Similar crude tools, particularly of limestone, were observed in a number of Iron Age sites in Masbate. Sites of this period never contain the small, well-made chert tools of the midden layers, which seem to represent a lithic technology which disappears with the introduction of metal tools

Seventeen of these small (1–3 cm maximum length) flake tools, some with marginal retouch, were found in the midden layers, most of them in the top 20 cm of Layer 4. They were all made of chert in a variety of colors: bright red, brown, and white. The flakes are thin and struck off a prepared core, although no associated cores were found. The presence of thin undamaged striking platforms in some flakes may indicate the use of soft hammers, though not in the manufacture of all flakes. Angles of the working edges range from 16° to 37°, except for one tool with a working edge of 67°. Three of the flakes showed signs of wear; the rest either had not been used or had not been subjected to sufficient use to produce visible wear. There are no signs of hafting. The organic material, apparently the result of hafting, which was found on 20 percent of flakes from the Buad Islands in nearby Samar is not found on the Bagumbayan flakes, the smallest of which must be near the lower size limit for effective hand-held tools (Cherry 1978) (Fig. 11).

Similar small, well-made flakes of chert or similar crypto-crystalline material were observed in six other sites in Masbate, usually in small clusters of two or three flakes on the ground surface. They were not associated with pottery or any other archaeological material.

The earliest stone tools were found beneath the marine deposits. Four large pieces of worked chert that were found may have been cores, but since they possessed a working edge were probably core tools. They were formed by direct percussion flaking on both faces (Fig. 11).

When these tools were discovered, at a depth of nearly 4 meters and below marine deposits, they were thought to possibly be of a Pleistocene date; there was a considerable resemblance between the Bagumbayan tools and the chopper tools from the Cagayan Valley in northern Luzon (Fox and Peralta 1974; Shutler and Mathiesen 1979; Dalupan 1981). In fact, by radiocarbon dating the tools are less than six thousand years old. As Hutterer (1976) and others have pointed out the level of stone tool technology in Southeast Asia and other Pacific regions does not have the simple chronological relationship of the European model, which is based on a gradual increase in technical sophistication over time. Technologically primitive stone tools appear at a late date in the Pacific region, and throughout the archaeological sequence there is a general lack of regularly recurring tool forms (Hutterer 1977a). In the Cagayan Valley alone, stone tools similar in morphology and technology to those possibly associated with Pleistocene fauna have been found, for example, at Laurente Cave associated with pottery, and at Rabal Cave with pottery and bronze rings (Ronquillo 1980; Dalupan 1981). Similarly at Bagumbayan the Iron Age stone tools, which are technologically the most primitive in terms of selection of raw materials and manufacturing techniques, are chronologically the most recent.

The obvious archaeological parallels to the Bagumbayan core tools of Layer 8 are the Hoabhinian core tools of Mainland Southeast Asia and Sumatra. Similar tools are recorded from the Pintu Rock Shelter, but these are mostly unifacially worked and are heavily outnumbered by flake tools, which comprised 88 percent of the lithic assemblage (Peterson 1974). Given that tools of this morphological type appear to have an enormously wide spatial and chronological distribution, such parallels are likely to indicate not wider cultural relationships but common environmental and economic factors (Hutterer 1977a).

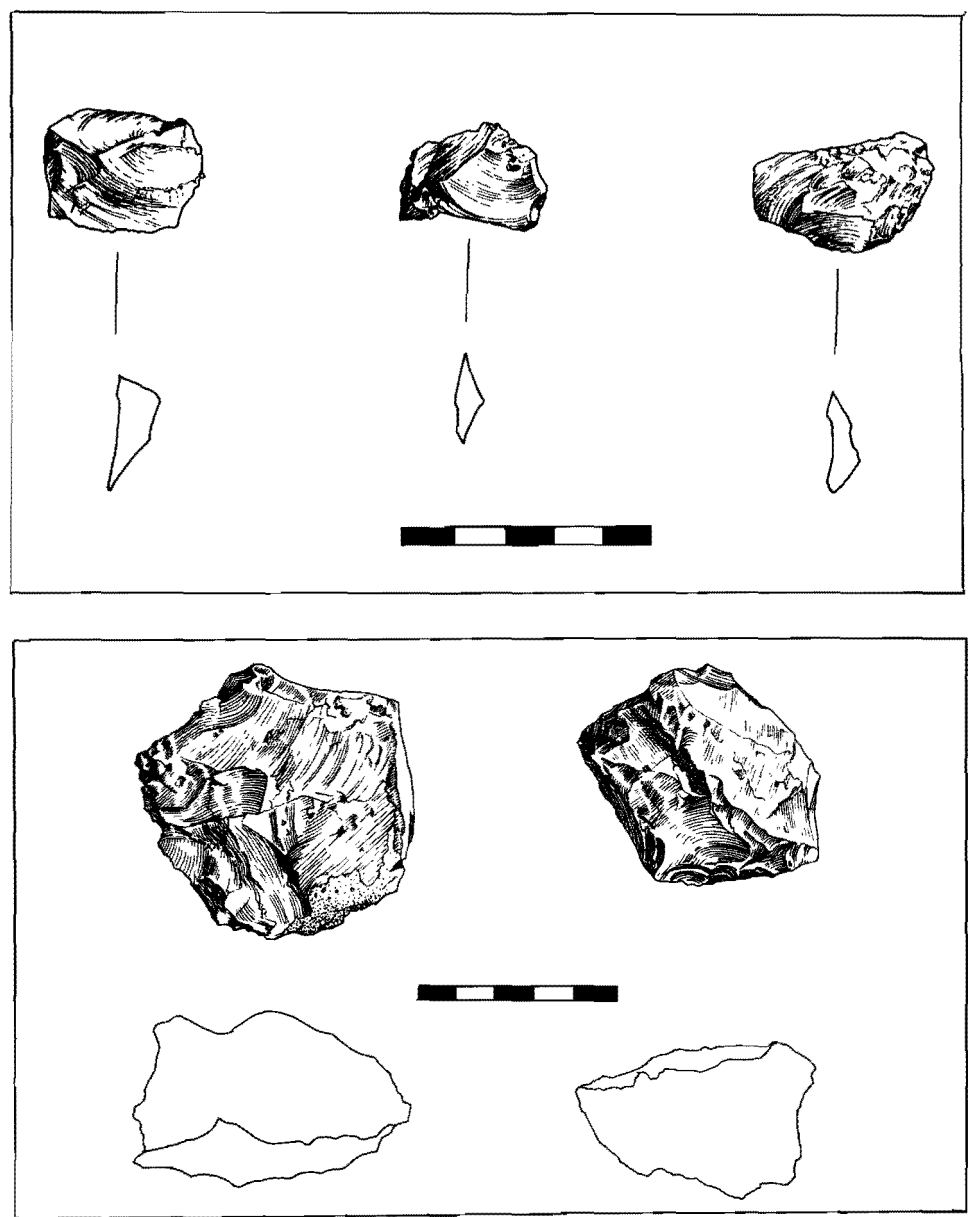


Fig. 11 Stone tools, Bagumbayan. Top: Layer 4; Bottom: Layer 7.

FAUNAL ANALYSIS

Molluscs

The most abundant faunal remains at Bagumbayan were the shells of edible molluscs, which comprised up to 5 percent by weight of Layers 4 and 5. There was a considerable lack of uniformity in the distribution of shell midden, which was concentrated in some parts of the excavated site and almost completely absent from others (Fig. 6). This lack of continuity in distribution was horizontal rather than vertical in that midden concentrations were constant over both layers.

All shell from the excavated area was washed, sorted into species, weighed, and counted (per square and per 20 cm spit within each layer). Much of the shell was fragmented, and to avoid duplication bivalves and gastropods were included in the count only if the hinge and spire respectively were present.

There were at least 21 species present in the midden. They were as follows:

LARGE BIVALVES	(Maximum length over 10 cm) <i>Tridacna maxima</i> , <i>Hyppopus hyppopus</i>
MEDIUM BIVALVES	(Maximum length 3–10 cm) <i>Anadara nodifera</i> , <i>Grafiarium tumidum</i> , <i>Hexaplex cichoreum</i> , <i>Barbatia bicolorata</i> , <i>Macra chinensis</i>
LARGE GASTROPODS	(Maximum length over 10 cm) <i>Lambis lambis</i> , <i>Lambis chiragra</i> , <i>Tectus fenestrus</i> , <i>Cypraea</i> spp.
MEDIUM GASTROPODS	(Maximum length 3–10 cm) <i>Conux marmoreus</i> , <i>Cerithium nodulosus</i> , <i>Turbo argyrostomus</i> , <i>Strombus luhuanus</i>
SMALL GASTROPODS	(0.5–3 cm) <i>Anodontia edulenta</i> , <i>Nerita chamæleon</i> , <i>Monilea belcheri</i> , <i>Oliva reticulata</i>
LAND SNAILS	<i>Helicostyla</i> spp., <i>Pythia dollex</i>

All these species are still found locally today in the shallow waters of the lagoon and enclosing reef. *Anadara nodifera*, *Hexaplex cichoreum*, *Barbatia bicolorata*, and *Grafiarium tumidum* are all bivalve species that live in soft sand or mud; they are much the same size as the European cockle. The two largest bivalves, the giant clams *Tridacna maxima* and *Hyppopus hyppopus*, inhabit reef or offshore rocks, as do most of the gastropod species. The land snails prefer a damp habitat, although *Helicostyla* can be found today outside marshlands in humid niches in woodland. *Pythia dollex* lives in saltwater marsh.

The total shell midden from the two layers in the excavated area weighed 77 kg, of which 63.699 kg (87.7%) could be identified as to species. Some of the land snails, though fairly large (4–6 cm long when adult) and often eaten, have very light shells and may have been washed into the site. All the marine shells in the midden layers are probably present in the site as the result of having been intentionally brought there by man, presumably for eating.

Table 1 shows the relative abundance of the different mollusc species, which reflects such factors as availability, food preference, and ease of exploitation. These same factors still apply to shellfish exploitation in the area. Observation of present-day collecting practices showed that by far the most important factor influencing species selection is individual body size: large shellfish are much preferred to small ones. The reasons for this lie in the nature of the tropical lagoon environment: as a typical mature ecosystem it

TABLE 1. SPECIES DISTRIBUTION OF MOLLUSCS, LAYERS 4 AND 5, BAGUMBAYAN (weights are in grams)

SPECIES	LAYER 4								LAYER 5							
	0-20 cm		20-40 cm		40-60 cm		60-80 cm		0-20 cm		20-40 cm		40-60 cm		60-80 cm	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Large Bivalves																
<i>Tridacna maxima</i>	77	4480	31	1790	7	290	30	2090	14	830	19	1420	13	1240	28	2040
<i>Hyppopus hyppopus</i>																
Large Gastropods																
<i>Tectus fenestrus</i>	57	670	4	30	3	50	8	100	8	50	13	170	—	—	1	110
<i>Lambis lambis</i>	84	8500	21	1010	7	490	28	1940	20	1000	22	840	5	290	6	380
<i>Cypraea</i> spp.	13	560	—	—	1	30	2	50	2	50	1	20	—	—	1	50
Medium Bivalves																
<i>Anadara nodifera</i>	882	6830	318	2090	100	530	291	1800	162	1005	206	1420	76	520	24	160
<i>Hexaplex cichoreum</i>	370	1950	224	890	76	380	152	720	141	650	21	90	147	750	129	730
<i>Grafiarum tumidum</i>	—	—	14	170	3	60	4	100	—	—	3	260	2	70	4	70
Medium Gastropods																
<i>Conus marmoreus</i>	36	745	7	160	1	10	4	80	3	40	5	80	—	10	4	110
<i>Cerithium nodulosum</i>	17	440	10	240	1	10	1	20	—	—	1	10	2	50	—	—
<i>Strombus luhuanus</i>	169	2400	16	200	13	150	41	530	35	310	30	270	8	60	4	30
Small Gastropods	227	2479	14	140	14	140	52	440	38	275	11	140	21	180	—	—
Land Snails																
<i>Helicostyla</i> spp.	16	485	4	120	4	120	10	230	3	140	15	350	15	400	14	170

contains a large number of species, none of which are common (Krebs 1978). The dense shellfish beds composed of one or a few species found in cold and temperate waters, which make up so much of the prehistoric shell middens of northern Europe, New Zealand, Australia, South America, and South Africa, are not typical of the tropical lagoon.

Selection for size means that the energy costs of collecting shellfish with a dispersed distribution can to some extent be compensated by the energy gained per individual shellfish although, as is discussed below, this compensation does not seem to be sufficient to make shellfish collection in such an environment a highly profitable activity.

Lawton's study, which showed the rate of energy expended to energy gained in food-gathering to be very similar over a wide range of species, including insects and birds, comments that "energetically expensive food-gathering techniques in animals can only be applied to food sources which show a high rate of energy return" (Lawton 1973:66).

A further important factor is the ease with which shellfish can be prepared for eating. Many of the gastropods are difficult to extract from the shell even after cooking. The shell of *Lambis lambis*, for example, has to be hammered open for the meat to be removed. Although the shell is large and very thick, all individuals of these species present in the Bagumbayan had been broken open. The time required to extract a serving of shellfish increases as the size of gastropods decreases. Bivalves, on the other hand, can be easily removed from the shell after cooking.

The same considerations of efficiency that determine the preference of local people today for large shellfish, and, particularly in the smaller size ranges, for bivalves rather than gastropods, are likely to have influenced prehistoric shellfish exploitation.

Analysis of the varying proportions of large and small bivalves and gastropods over time show a high proportion (by weight) of giant clams (56%) at the base of the midden (Fig. 12). The lowest midden level may represent the initial exploitation of a relatively untouched shellfish population which culled the largest, most visible, and most easily prepared species. Subsequent exploitation shows a reduction in the percentage of large bivalves, while the top level of midden contains the lowest percentage of bivalves and the highest percentage of small gastropods.

It should be noted that differences in species representation between squares of the same midden level were in some cases greater than the differences between the average values of different levels. In describing the result of multiple exploitation events in a highly diverse resource zone such as the tropical lagoon, such heterogeneity is to be expected.

Throughout the midden the quantity of shellfish and the amount of edible meat they represent is fairly small. The proportion of meat to shell weight in marine molluscs has been variously estimated at c. 20 percent (Diem 1962; Meehan 1977:496) to 20–60 percent with an average of 32.5 percent (Shawcross 1967:121). A limited analysis of modern shellfish populations in the lagoon near Bagumbayan showed that on average 30 percent of the total shell weight was meat. The percentage varies according to species and size: large specimens tend to have a lower ratio of meat to shell weight than smaller individuals of the same species (see Terrell, quoted in Shawcross 1967).

The excavated midden at Bagumbayan thus represents approximately 15.4 kg of edible meat at the 20 percent proportion of meat to shell, or 25 kg at 32.5 percent. Even the higher figure represents less than a week's total nutritional requirements for a single adult.

Available studies of shellfish collection in tropical waters indicate that typically it contributes only a small part of the diet. Meehan's study of foraging by a group of Anbara Aborigines in Arnhem Land shows considerable seasonal variation in the contribution of different food resources, that of shellfish ranging between 2.5 percent and 8.9 percent of

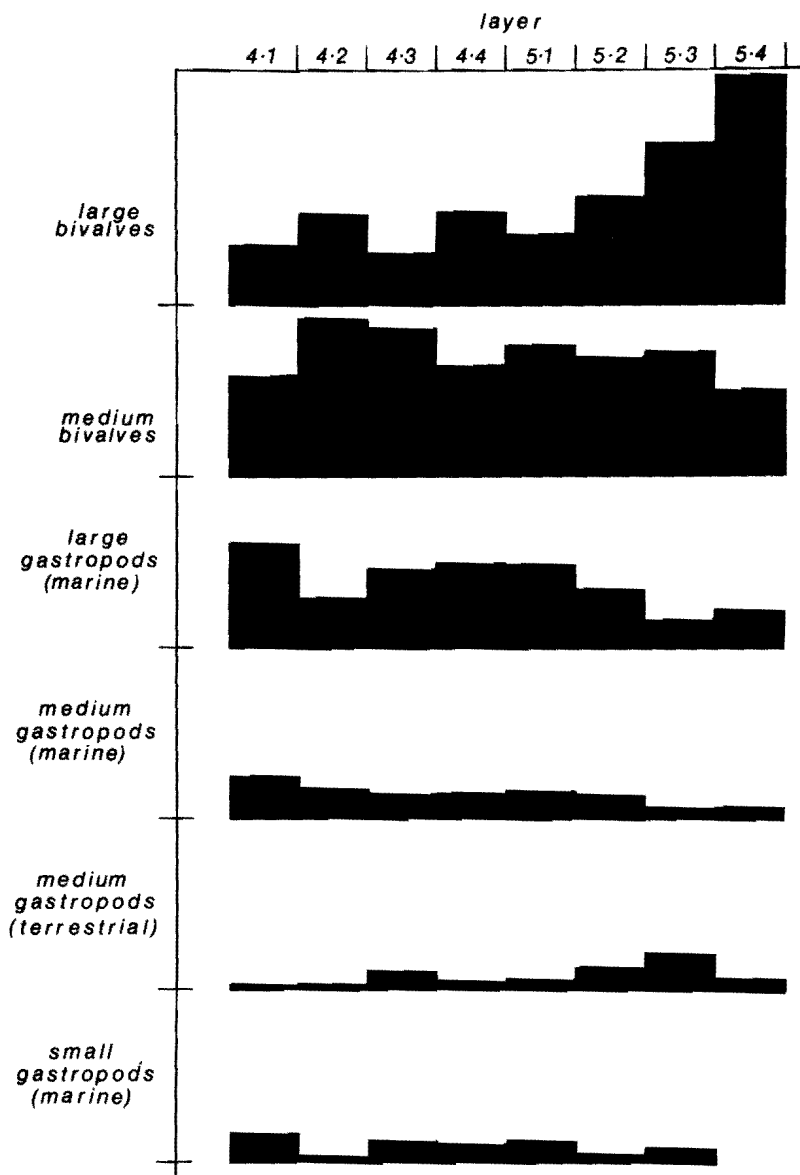


Fig. 12 Distribution of main classes of mollusc, Layers 4 and 5.

calories eaten. The shellfish, mainly bivalves, were particularly important during January, which was the month of lowest calorific intake and also the period when stormy weather washed live shellfish up onto the beach (Meehan 1977). A dietary study of the Onge on Little Andaman Island indicates that shellfish contributed only 0.09 percent of the daily caloric intake: vegetable foods, pigs, and fish were the most important food resources (Bose 1964; Meehan 1977). Similarly the Tikopia, who unlike the Onge and Anbara have a sedentary agricultural economy, make little use of shellfish except when bad weather prevents canoe fishing (Firth 1965:76).

The importance of shellfish as a dependable and predictable resource, unaffected by

variations in the weather or in human skill, has been emphasized by Meehan in her study. Shellfish may well have played the same role at Bagumbayan as in Tikopia, a source of marine protein available when fishing was not possible. Unlike the southern coast, which is dangerous for canoes during the period of prevailing northeasterly winds from October to May, the northern coast where Bagumbayan is situated is sheltered with deep offshore waters, and fishing is possible throughout the year. Ever year, however, storms occur which prevent fishing for several days, and shellfish may have been an important source of protein during this time. Alternatively, shellfish collection may have been carried out periodically as a supplement to other types of economic exploitation, particularly, as among the Anbara and in Palanas today, by those not heavily engaged in other types of food-getting activity.

It seems clear that, whatever the economic context of shellfish collection may have been, it did not provide a large part of the diet. The comparatively small contribution is probably because the time and energy expended in shellfish collection did not produce a sufficiently high yield. An analysis of present-day shellfish gathering showed a low rate of return per man-hour invested. Collecting expeditions by experienced fishermen at low tide over timed periods yielded on average only 91 gm of shellfish per man-hour of work, or 18–40 gm of edible meat. This in turn represents less than 50 Kcal: in other words, the energy obtained from shellfish collection is rather less than the energy required to maintain an adult human being over the same period of time.¹

Even lower rates of energy return are recorded, particularly in the exploitation of protein foods, in subsistence economies. O'Connell, for example, assesses the caloric returns of lizard collection among the Alawara Aborigines at 40 Kcal per man-hour of effort (O'Connell 1982). However, since the successful human economy produces ipso facto a surplus of calories gained to calories expended in economic exploitation, such activities are likely to be peripheral and occasional.

Other Marine Species

Over 100 fish bones were present in the midden layers. A detailed identification is not yet completed, but they included mullet and remains of several sharks and stingrays; at least one lobster was present in Layer 5. Shark were also present in Layer 8, which contained the skull and mandible of a large marine turtle (*Cheilon midas*).

Mammals

The following mammal bones were identified in the site fauna:

- | | |
|---------|--|
| Layer 4 | Two fragments of acetabulum and ilium of left pelvis, <i>Rusa</i> sp.
Left M ³ of <i>Sus</i> sp. (very small adult) |
| Layer 5 | Fragment lower molar <i>Rusa</i> sp.
Right upper canine <i>Sus</i> sp.
Left M ₃ and portion of mandible of <i>Sus</i> sp. (different individual than preceding)
Axe made of antler of <i>Rusa</i> ? <i>alfredi</i> |

¹ Caloric value of shellfish per 100 gm = Kcal (Diem 1962). Average caloric requirements per day = c. 2000 Kcal (McArthur 1960).

Layer 7	Right P ² <i>Rusa</i> ? <i>basilensis</i>
	Left M ₁ <i>Rusa</i> ? <i>basilensis</i>
	Fragment left pedicle and frontal of large cervid (<i>Rusa</i> ? <i>alfredi</i>)
	Distal end humerus <i>Sus</i> sp.

The identified mammal bones are all of pig and deer. Both were found beneath the marine deposits; both are also present, though sparsely, in the midden layers.

Deer are now extinct in Masbate; wild pig are sometimes hunted, but these may well be feral. Since there are no living representatives of the prehistoric fauna, it is difficult to ascribe species. The deer remains, particularly those in Layer 7, closely resemble specimens of *Rusa basilensis* Heude. This species is, however, considered by Taylor (1934) to be either the same species as *Rusa alfredi*, the spotted sambar deer, or a subspecific form of the species. Modern skeletal specimens of *Rusa basilensis* did appear to be rather smaller than those of *Rusa alfredi* but also showed a marked degree of heterogeneity. Since the present recorded distribution of *Rusa alfredi* is in the islands of the central Philippines (Cebu, Leyte, Samar, Negros, and Panay) (Rabor 1977), where the deer comprise isolated breeding populations within limited land areas, a relatively high degree of intraspecific variation is to be expected. Published descriptions of deer species in the Philippines refer mainly to nonskeletal features (for example, Taylor 1934), and it is difficult to relate these to archaeological material. Similar problems apply to the identification of *Sus* species in the site fauna.

SEED REMAINS

A froth flotation machine was used at Bagumbayan over both seasons. A total of 14 cubic meters of soil were processed, using a flotation machine after the design by Jarman, Legge, and Charles (1972), whereby an air pump drove fine bubbles through a flotation chamber filled with water and a frothing and a collecting agent. The soil was coarsely sieved before processing to break up clay lumps and remove large objects such as stones.

Although test runs using modern carbonized seeds showed a 25-30 percent retrieval rate, no prehistoric cereal remains were found at Bagumbayan. The most common floral type, present in Layers 3, 4, and 5, were *Euphorbiaceae*, with (probably modern) *Amaranthus* and *Rosaceae* in Layer 5. Three specimens of rice removed while processing soil from Layer 5 appear to be modern. The *Euphorbiaceae* are possibly also a modern intrusion in that one specimen examined microscopically was stained black with fungal hyphae rather than carbonized.

The water used in the flotation machine came directly from an underground spring and was filtered through a 0.3 mm sieve before use. The cause of contamination is probably the burrowing action of animals.

CONCLUSIONS

The present town of Palanas, where Bagumbayan is located, appears to have a history of human occupation extending back over five thousand years, although occupation at Bagumbayan was not continuous over this period. Geological processes have altered the landscape considerably, but one factor of vital importance to the local economy today has probably remained constant: the presence of the Palanas River and a lowland environ-

ment created by the river as it emerges from the hills of the interior and enters the sea. The catchment area of the river is extensive, and the Palanas River is one of the few on the northern coast to carry a substantial head of water throughout the year. Because of the presence of fresh water the coral reef is interrupted near the river mouth and a sandy beach has formed, which is a considerable advantage in fishing in that canoes can be safely landed and beached. It was noted during the site survey that nearly all Iron Age sites lay on sandy beaches, probably for this reason. A few sites were situated on pebble beaches but none were found on rocky shores even where these were adjacent to good arable land (Bay-Petersen 1981).

There is little information on the economic basis of the earliest cultural deposit. Pig and deer were available in Masbate at this time and seem to have been exploited, but there were no seed remains, and the associated marine species, including turtle, may be a natural deposit. Hutterer (1977a) has suggested that core tools of the type found in this layer may have been used for working wood; unfortunately, the remains of wood found with the deposit showed no signs of working. At the time the remains were deposited the excavation area was under the sea, probably near the edge of a shallow lagoon or estuary with the shore rising into the foothills of the hinterland a few meters to the south.

More economic information is available for midden Layers 4 and 5, but this is incomplete as none of the resources identified and analyzed would seem to have provided a viable economic base for a settlement which—judging from the depth of midden deposit and the quantity of associated cultural remains—was probably occupied for a considerable period of time.

The most visible food remains, the marine molluscs, probably comprised only a minor part of the diet. Fishing may have been important, and pig and deer were also exploited, but there is evidence of only a few individuals of either species. As in other coastal excavations in the Philippines, marine species probably made up the bulk of the food represented by the midden material (see, for example, Hutterer 1973; Jocano 1975:162).

Notably lacking from the economic evidence is any indication of a carbohydrate staple. Cereal remains present in the midden are almost certainly intrusive. The absence of reliable cereal remains does not necessarily imply the absence of such crops from Masbate during this period. They are also absent from the Iron Age deposit which postdates the introduction of rice into the Philippines and probably into Masbate.

The earliest known historic record of agriculture in the Palanas area dates from 1850, three years after Masbate began to pay tribute to the Spanish administration and several decades before cattle ranching was introduced to the island (Bay-Petersen 1981:128). Palanas was described as a successful agricultural area producing rice, sweet potato, fruit, and the introduced maize (Bravo 1850). An 1848 census report recorded that 895 people lived in the Palanas area. Another census two years later stated that out of a total population of 5489 in Masbate, 1849 lived in the municipality of Palanas (Perez 1848; Bravo 1850). The difference in the two reports was probably the result of census difficulties and variation in the definition of census zones rather than of abrupt population growth. A later census in 1890 reported the population of Masbate as 19,517, of whom 2655 lived in the municipality of Palanas. By this time the number of municipalities had increased from three to nine. A description of land use around Palanas reported 140 hectares (0.4%) of cultivated land, 24,703 hectares (65.7%) of cogon grass, and 12,753 hectares (33.9%) of woodland (Torres, 1890). Historic records of Masbate indicated that extensive deforestation probably predates the colonial era and was the result of indigeneous agricultural practices, possibly resulting in changes in settlement pattern (Bay-Petersen 1981).

The most important agricultural zone in the Palanas area today is the coastal plain and the alluvial silts of the lower river valley. At the period of site occupation represented by the midden layers, the site was probably very near the beach, and there was only a very limited development of the coastal plain. West of the site, and immediately adjacent to it, lay riverine swamp. The *nipa* palm, used in thatching and weaving, would probably have grown here, and, if the water was not brackish, edible hydrophytic species such as the large aroid *Cytosperma merkusii*, possibly *Colocasia esculenta*, the fern *Athyrium esculentum* with its relatively high protein content, and the edible tubers of the sedge *Eleocharis dulcis* (Brown 1941-1943; Merrill 1912). If rice was grown, freshwater marshes would be a highly suitable habitat. The associated land snails found in these layers were all of the freshwater species *Helicostyla*.

Indigenous yams and other edible plant species, whether indigenous or introduced, would have found a suitable habitat on the adjacent uplands. There is no indication from the site data whether plant foods were cultivated or foraged. The one possible agricultural tool, the antler axe, could have been used by hunter-gatherers for the exploitation of wild tubers.

Probable economic patterns cannot be assessed from archaeological parallels. In terms of location Bagumbayan resembles the open-air coastal site of Dimolit, which contains flake tools and pottery that includes the plain globular forms of Bagumbayan but also comprises red-slipped ware and a number of complex forms. The harvesting of cereals (probably wild) is indicated at Dimolit by the presence of grinders, mortars, and flake tools with silica gloss, none of which is found at Bagumbayan (Peterson 1974).

The archaeological assemblage most similar to the midden layers of Bagumbayan appears to be that of Sohoton Cave in Samar, which contains small flake tools and plain globular earthenware vessels, with some sherds of a more sophisticated incised and slipped earthenware (Hutterer 1974). The sequence at Sohoton covers from $10,500 \pm 160$ B.P. to 385 ± 105 B.P. (Hutterer 1974; Tuggle and Hutterer 1972). Flake tools and plain pottery, both more variable than those of Bagumbayan, are also found at Pintu Rock Shelter.

Both sites seem to be based on hunting and gathering, but both are located on rivers in nonarable uplands, and the economic exploitation at Sohoton shows considerable continuity into the sixteenth century A.D. It has been suggested that the hunters and gatherers at Sohoton may have been partners in an exchange system with lowland agriculturalists who provided the pottery found at the site (Hutterer 1974). Such an exchange system is well documented ethnographically in the Palanan Bay area of northern Luzon, where Pintu Rock Shelter is situated (Peterson and Peterson 1977).

Information of this kind is causing archaeologists to revise evolutionary concepts of the introduction and development of agriculture and to adopt models more consistent with a complex reality of numerous interrelated subsistence economies with a variable agricultural component (see Harris 1981). Certainly a transition into agriculture occurred among the majority of prehistoric hunting and gathering economies, but the transition was probably a slow one in many areas, and the distinction between nonagricultural and early agricultural economies in Southeast Asia is unlikely ever to be clearly defined in the archaeological record. Since early agriculture in this area was probably based on indigenous species in their natural habitat, the transition into intensive exploitation was presumably gradual and dependent on factors other than technological knowledge. The simple tools of the tropical slash-and-burn farmer—digging stick and cutting implement—are also used by the hunter-gatherer who is frequently aware and makes use of the mechanics of plant propagation. Hunter-gatherer groups in the Philippines and elsewhere regularly

propagate wild yams: the Tasaday, for example, replant the crown after the yam is harvested (Fernandez and Lynch 1972:304; Yen 1976:160; Dentan 1968:47; Bay-Petersen in press). The point where cultivation becomes recognizable in the archaeological record, when it involves the exploitation of introduced cultigens or results in identifiable economic change, may postdate early agriculture by a considerable period.

ACKNOWLEDGMENTS

I should like to express my thanks to the British Academy and the British Institute in Southeast Asia, and the University of Cambridge Evans Fund, who funded the fieldwork. The radiocarbon dates were also financed by the British Academy. The preparation and photography of thin sections was carried out by Ann Woods, University of Leicester. I should also like to thank the staff of the National Museum of the Philippines for their help and kindness during the field season. Finally I should like to express my deep gratitude to Mr. and Mrs. Cesar Punzalan, Jr., our generous and hospitable hosts in Palanas; to Mr. Romulo V. Atendido, also of Palanas, who discovered the archaeological deposit while digging a well and informed us of it; and to the industrious and dedicated workmen of the excavation team.

All artifacts were deposited with the National Museum of the Philippines.

REFERENCES

BAY-PETERSEN, J.

- 1981 Shifting cultivation in prehistory: economic change in Masbate, Central Philippines. In *Adaptive Strategies and Change in Philippine Swidden-based Societies*, edited by H. Olofson. Laguna: Forest Research Institute
- In press Early agriculture in tropical and temperate environments: the ecological implications. Symposium on the *Origins of Agriculture and Technology: East or West Asia?* Aarhus.

BELLWOOD, P.

- 1976 Archaeological research in Minahasa and the Talaud Islands, northeastern Indonesia. *AP* 19(2): 240-288.
- 1978 *Man's Conquest of the Pacific*. London: Collins.
- 1980 The Buidane Culture of the Talaud Islands, North-Eastern Indonesia. *Bulletin of the Indo-Pacific Prehistory Association* 2:69-127.

BOSE, S.

- 1964 Economy of the Onge of Little Andaman. *Man in India* 44:298-310.

BRADLEY, R., AND M. FULFORD

- 1980 Sherd size in the analysis of occupation debris. *University of London Institute of Archaeology Bulletin* 17:85-94.

BRAVO, FR. F.

- 1850 *Diccionario geographico, estadistico, historico de las Islas Filipinas*. Madrid.

BROWN, W. H.

- 1941-43 *Useful Plants of the Philippines*. Department of Agriculture and Commerce, Technical Bulletin no. 10, 3 vols. Manila.

CHERRY, R.

- 1978 An analysis of the lithic industry of Buad Island, Samar. *Philippine Quarterly of Culture and Society* 6:3-80.

CHIONG, L. T.

- 1974 The present methods of pottery manufacture in Daro, Dumaguete City, Philippines: a tribute to the past. *Proceedings of the First Regional Seminar on Southeast Asian Prehistory and Archaeology, June 26-July 4, 1972*. Manila: National Museum.

- COUTTS, P. J. F., AND J. P. WESSON
1978 Field reconnaissance on Eastern Panay Island, Philippines. *Bulletin of the Indo-Pacific Prehistory Association* 1:21-46.
- DALUPAN, M. L.
1981 The prehistoric occupation of Lattu Lattuc Cave: the evidence of the ceramics. Master's thesis, Ateneo de Manila University, Philippines.
- DE BOER, W. R., AND D. W. LATHRAP
1979 The making and breaking of Shipibo-Conibo pottery. In *Ethnoarchaeology: Implications of Ethnography for Archaeology*, edited by C. Kramer. New York: Columbia University Press.
- DENTAN, R. K.
1968 *The Semai*. New York: Holt, Rinehart and Winston.
- DIEM, K., ED.
1962 *Documenta Geigy, Scientific Tables*, 6th edition. Macclesfield, Cheshire: Geigy (U.K.) Ltd., Pharmaceuticals Division.
- FERNANDEZ, C. A. II, AND F. LYNCH
1972 The Tasaday: cave-dwelling food gatherers of South Cotobato, Mindanao. *Philippine Sociological Review* 20:279-313.
- FIRTH, R.
1965 *Primitive Polynesian Economy*, 2nd edition. London: Routledge and Kegan Paul.
- FOX, R. B.
1970 *The Tabon Caves: Archaeological Explorations and Excavations on Palawan Island, Philippines*. Manila: National Museum.
- FOX, R. B., AND J. T. PERALTA
1974 Preliminary report on the Paleolithic archaeology of Cagayan Valley, Philippines. In *Proceedings of the First Regional Seminar on Southeast Asian Prehistory and Archaeology, June 26-July 4, 1972*. Manila: National Museum.
- HARRIS, D. R.
1981 Breaking ground: agricultural origins and archaeological explanations. *University of London Institute of Archaeology Bulletin* 18:1-20.
- HUTTERER, K.
1969 Preliminary report on archaeological field work in Southwestern Samar. *Leyte-Samar Studies* 3:37-56.
1973 *An Archaeological Picture of a Pre-Spanish Cebuano Community*. San Carlos Publications. Series A, Monograph 9. Cebu.
1974 The evolution of Philippine lowland societies. *Mankind* 9:287-299.
1976 An evolutionary approach to the South-east Asian cultural sequence. *CA* 17:221-242.
1977a Reinterpreting the Southeast Asian Paleolithic. In *Sunda and Sahul: Prehistoric Studies in Southeast Asia, Melanesia and Australia*, edited by J. Allen, J. Golson, and R. Jones. London: Academic Press.
1977b Prehistoric trade and the evolution of Philippine societies: a reconsideration. In *Economic Exchange and Social Interaction in Southeast Asia: Perspectives from Prehistory, History and Ethnography*, edited by K. Hutterer. Papers on South and Southeast Asia 13. Ann Arbor: University of Michigan.
- JARMAN, H. N., A. J. LEGGE, AND J. A. CHARLES
1972 Retrieval of plant remains from archaeological sites by froth flotation. In *Papers in Economic Prehistory*, edited by E. S. Higgs. Cambridge: Cambridge University Press.
- JOCANO, F. LANDA
1975 *Philippine Prehistory: An Anthropological Overview of the Beginning of Filipino Society and Culture*. Quezon City: University of the Philippines.
- KIRBY, A., AND M. J. KIRBY
1976 Geomorphic processes and the surface survey of archaeological sites in semi-arid areas. In *Geoarchaeology*, edited by D. A. Davidson and M. Shackley. London: Duckworth.
- KREBS, C. J.
1978 *Ecology: The Experimental Analysis of Distribution and Abundance*, 2nd edition. New York: Harper and Row.
- KRESS, J. H.
1980 The ceramics from Pilanduk Cave and Saigung Rockshelter, Quezon Municipality, Palawan Island, the Philippines. *AP* 21(1):58-85.

- LAWTON, J. H.
1973 The energy costs of food-gathering. In *Resources and Population*, edited by B. B. Cox and J. Peel. Proceedings of the 9th Annual Symposium of the Eugenics Society, London.
- LEGASPI, A. M.
1972 Metal artefacts in some Philippine archaeological sites. *Proceedings of the First Regional Seminar on Southeast Asian Prehistory and Archaeology, June 16–July 4, 1972*. Manila: National Museum.
- MCARTHUR, M.
1960 Food consumption and dietary levels of groups of Aborigines living on naturally occurring foods. In *Records of the American-Australian Scientific Expedition in Arnhem Land*, edited by C. P. Mountford. Melbourne: Melbourne University Press.
- MEEHAN, B.
1977 Man does not live by calories alone: the role of the shellfish in a coastal cuisine. In *Sunda and Sahul: Prehistoric Studies in Southeast Asia, Melanesia and Australia*, edited by J. Allen, J. Golson, and R. Jones. London: Academic Press.
- MERRILL, E. D.
1912 Notes on the flora of Manila with special reference to the introduced elements. *PJS* 7(4):145–208.
- O'CONNELL, J. F.
1982 Ethnoarchaeology among the Alawara. In *The Archaeology of Hunter-Gatherers. Symposium of the Prehistoric Society*, London.
- PEREZ, J.
1848 Copia del gobierno consiguiente a la descrippcion de las islas de Masbate y Ticao, 1848. Unpublished manuscript. Manila: National Archives.
- PETERSON, J. W., AND W. PETERSON
1977 Implications of contemporary and prehistoric exchange systems. In *Sunda and Sahul: Prehistoric Studies in Southeast Asia, Melanesia and Australia*, edited by J. Allen, J. Golson, and R. Jones. London: Academic Press.
- PETERSON, W.
1974 Summary report of two archaeological sites from Northeastern Luzon. *APAO* 9:26–35.
- RABOR, D. S.
1977 *Philippine Birds and Mammals*. Quezon City: University of the Philippines.
- RONQUILLO, W. P.
1980 The technological and functional analysis of lithic flake tools from Rabel Cave. Northern Luzon, Philippines. Master's thesis, Department of Anthropology, University of Pennsylvania.
- SCHEANS, D. J.
1977 *Filipino Market Potteries*. National Museum Monograph 3. Manila.
- SCHIFFER, M. B.
1972 Archaeological context and systemic context. *American Antiquity* 37:156–165.
- SHAWCROSS, F. W.
1967 An investigation of prehistoric diet and economy on a coastal site at Galatea Bay, New Zealand. *Proceedings of the Prehistoric Society* 33:107–131.
- SHUTLER, R., JR., AND MATHISEN
1979 Pleistocene studies in the Cagayan Valley of Northern Luzon, Philippines. *JHKAS* 8.
- Soil Survey of Masbate Province*
1964 Soil Report 33, Bureau of Soils. Manila.
- SOLHEIM, W. G. II
1955 Notes on the archaeology of Masbate. *Journal of East Asiatic Studies* (Manila) 4(1):47–50.
1964 *The Archaeology of the Central Philippines: A Study Chiefly of the Iron Age and its Relationships*. Monographs of the National Institute of Science and Technology 10. Manila.
1968 The Batungan Cave Sites, Masbate, Philippines. *APAS* 2:21–62.
- SPOEHR, A.
1973 *Zamboanga and Sulu*. Ethnology Monographs 1. Pittsburgh: Department of Anthropology, University of Pittsburgh.
- STODDART, D. R., P. E. GIBBS, AND D. HOPLEY
1981 *Natural History of Raine Island, Great Barrier*. Atoll Research Bulletin 254.

- TAYLOR, E. H.
1934 *Philippine Land Mammals*. Manila: Bureau of Printing.
- TENAZAS, R.
1974 A progress report on the Magsuhot Excavations in Bacong, Negros Oriental. *Philippine Quarterly of Culture and Society* 2:133-155.
- TORRES, M.
1890 Memoria descriptiva de la provincia de Masbate y Ticao correspondiente al año de 1890. Unpublished manuscript, National Archives, Manila.
- TUGGLE, H. D., AND K. L. HUTTERER, EDS.
1972 *Archaeology of the Sohoton Area, Southwestern Samar, Philippines*. Leyte-Samar Studies 6(2).
- YELLEN, J. E.
1977 *Archaeological Approaches to the Present: Models for Reconstructing the Past*. New York: Academic Press.
- YEN, D. E.
1976 The ethnobotany of the Tasaday: III. Notes on the subsistence system. In *Further Studies on the Tasaday*, edited by D. E. Yen and J. Nance. Panamin Foundation Research Series no. 2. Makati, Rizal, Philippines.